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Debt and International Finance

International Economics Department
The World Bank
June 1990
WPS 450

WPS 450

Portfolio Effects of Debt-Equity Swaps and Debt Exchanges with Some Applications to Latin America

Daniel Oks

This model explains why debt-equity swaps tend to raise the steady-state price of sovereign debt in Chile and Brazil and reduce it in Argentina and Mexico.

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WORKING PAPERS

Debt and International Finance

WPS 450

This paper — a product of the Debt and International Finance Division, International Economics Department — is part of a larger effort in PRE to assess the macroeconomic effects of voluntary debt reduction. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Sheila King-Watson, room S8-025, extension 31047 (37 pages with tables).

Oks proposes a portfolio equilibrium model for assessing the short-term and long-term macroeconomic effects of debt buybacks and debt equity-swaps.

He examines the main results in the light of recent Latin American experience with voluntary debt reduction. He shows that in the short-term, debt-equity swaps are inflationary and raise real equity and sovereign debt prices — and that foreign debt buybacks at a discount raise real equity and sovereign debt prices.

The steady-state impact of debt-equity swaps on sovereign debt prices hinges on the values of

the following parameters: the foreign resource transfer a country can make, the ratio of domestic equity held by foreigners to a country's foreign debt, the terms of the debt-equity exchange, the rate of profit or equity, the rate of profit remittances, and the technology (decreasing, constant, or increasing returns to scale).

Estimates of these parameters indicate that debt-equity swaps raise the steady-state price of sovereign debt in Chile and Brazil and reduce it in Mexico.

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I thank Bella Balassa, Stijn Claessens and Jonathan Eaton for useful comments on a previous draft of this paper.

1. INTRODUCTION

Voluntary debt reduction schemes (VDR), such as debt-equity swaps (DES) or collateralized debt conversions¹ (CDC), are bound to play a relevant role in the foreign debt strategy of highly indebted countries (HICs). Deep discounts on the price of sovereign debt in secondary markets constitute the single most important incentive for debtors and foreign investors to engage in VDR. Some of the factors behind these discounts are: high international real interest rates, which make debt service more burdensome and eventually unfeasible; the reduced creditworthiness of sovereign borrowers, following a deterioration in domestic fiscal situations; and the overall poor performance of HICs under conventional schemes of external financing with the consequent realization that debt problems are not just a consequence of a liquidity crisis. The recent surge in VDR activity is also linked to the strengthening of commercial banks' balance sheets, and the recent commitment of public monies from creditor governments and multilateral agencies to finance debt exchanges at a discount, i.e., the Brady Initiative.

Debtor countries may benefit from VDR due to several factors: cash-flow relief; wealth effects; incentive effects; a reduction of uncertainty and country risk premia; and an improvement in public finances. Cash-flow relief stems from principal and interest reduction and, if foreign debt is public, it

1. A collateralized debt conversion is an exchange of old debt for new collateralized or guaranteed debt at a discount. The discount increases with the degree of collateralization, but may also depend on other attributes of the new debt, e.g. the new debt may be treated as senior debt and hence be exchanged at better terms with the old debt.

contributes to improve public finances. Since debt is subtracted from assets to calculate wealth, VDR may raise perceived wealth and, hence, reduce saving.² VDR may reduce uncertainty about future economic policy if it lowers significantly the debt service by reducing the likelihood of default (the benefits of default drop relative to the cost of default). A lower foreign public debt service may also lower expectations of future taxation and, hence, constitute an incentive for investment. Finally, if VDR have a more than transitory beneficial effect on the price of debt in secondary markets, an issue on which this paper focusses, the lower secondary market discount is likely to imply (*ceteris paribus*) lower risk-adjusted rates of return; e.g. because restrictions on profit remittances become less likely as the country's creditworthiness improves.

On the other hand, VDR carry costs in terms of: foreign liquidity; e.g., in the case of CDC because reserves are allocated for collateralization; inflation, e.g., in the case of money-financed DES of private equity for public debt; higher debt prices, which imply more expensive VDR; and the risk that the debt repurchase effort turns out to be useless if creditworthiness cannot ultimately be regained.

A rapidly developing branch of the literature has dealt with the incentive effects of debt relief, e.g., Krugman (1987) and Sachs (1986). A large public foreign debt may create investment disincentives because potential investors perceive that future output would go, via higher taxes, to service the foreign debt. In this context debt relief constitutes an incentive for investment, since a lower debt induces a country to invest more

2. See Oks (1990) for an analysis of wealth effects of VDR.

and adjust, hence, raising the long-term ability of the country to service its foreign debt. On the other hand, Corden (1988) argued that excessive debt relief may also have a disincentive effect on investment. Beyond the point where the country is no longer deterred from investing due to expected high future taxes, debt relief reduces, rather than increases, investment and the associated trade surplus. The reason being that debt relief raises perceived wealth, and ,hence, reduces the saving rate of the country. More recently, Diwan-Claessens (1989) provided a comprehensive analysis of potential efficiency gains from debt reduction assessing whether, and under which conditions, can debt reduction be in the interest of debtors and/or creditors.

Other authors have focused their attention on liquidity effects. Froot (1988) argued that liquidity constraints are likely to be more important than incentive constraints in explaining low levels of investment in debtor countries. Thus, liquidity relief could be more helpful than debt relief. Several more empirically-oriented studies look at the cash-flow dimension of VDR, e.g., Lamdany (1988), Sanguines (1989) and Larrain (1989). These studies also provide good descriptions of VDR programs in Bolivia, Mexico and Chile.

The dynamic impact of VDR on sovereign debt prices has been analyzed by Rodriguez (1989) and Dooley-Simansky (1989). On the other hand, Schmidt-Hebbel and Morande (1989) focused on the impact of VDR on equilibrium levels of sovereign debt prices. In this paper, we take a similar approach as theirs. While our approach is based on a rather more simplified portfolio equilibrium context, we also look at other domestic macroeconomic effects of VDR.

There have been relatively few attempts to assess the effects of VDR on domestic macroeconomic variables that most concern policy makers in debtor countries. One exception is Velasco (1988) who in a utility maximizing framework assessed the impact of debt swaps on inflation, exchange rates and the current account.

In a more conventional portfolio framework, in this paper we also assess the impact of VDR on domestic macroeconomic variables. More specifically, the objective of this paper is to evaluate the impact of DES and CDC on inflation, on equity prices and on sovereign debt prices.

For that purpose we first formulate a short term portfolio balance model with domestic and foreign assets/liabilities. A distinctive feature of the model is that all current transactions take place at end of period prices. The model supports the view that DES are inflationary. Reportedly, this view has led Latin American governments to interrupt DES programs in several occasions. Recent empirical evidence from Latin America in fact shows some correlation between DES and inflation. The model also indicates that in the short term DES and CDC are likely to raise equity prices and sovereign debt prices. We did find some empirical support for these results as well in the cases of Chile and Mexico.

Two important limitations of the short term model proposed are that asset stocks are fixed and profit remittances from foreign held equity are not treated endogenously. Thus, we formulate a long term model where asset stocks and profit remittances are determined endogenously. We show that the impact of DES on sovereign debt prices depends on a host of factors: the expected trade surplus, the stocks of debt and foreign-held equity, the redemption price of debt, restrictions on profit remittances, the physical rate of return

on equity and the technology that determines it. The technology was also found to be crucial for determining the steady state impact of DES on the stock and price of equity. A discussion regarding the dynamics of adjustment to the steady state illustrates possible linkages between DES subsidies, rates of return and investment levels.

The paper concludes with a parametrization of the conditions under which DES can lead to higher debt prices in selected Latin American countries. The evidence suggests that in Brazil and Chile DES are bound to lead to higher steady state debt prices, whereas the opposite occurs in Argentina and Mexico.

In Section 2 we formulate the short term portfolio model. In Section 3 we derive the comparative static effects of DES and CDC, and in Section 4 we examine the model predictions in the light of the recent Latin American experience. In Section 5 we present the long term model and assess the steady state effects of DES. In Section 6 we use this model to evaluate empirically the potential impact on sovereign debt prices of a DES program. In Section 7 we summarize the conclusions.

2. AN "END OF PERIOD" SHORT-TERM PORTFOLIO MODEL

In order to assess the short-term financial impact of VDR we formulate a short-term "end of period equilibrium" portfolio model with perfect myopic foresight.

The model assumes perfect myopic foresight and is of the end of period equilibrium type, in the sense that equilibrium requires that all markets clear when all assets/liabilities are valued at correctly anticipated end of period prices. For example, demand for money matches the stock of real money

obtained deflating the nominal stock of money with the end of period inflation price index. Similarly, equity and sovereign debt stocks are valued at correctly anticipated end of period prices. Consistency requires that real wealth should also be measured at end of period prices. One crucial advantage of the end of period formulation is that changes in the rates of return of assets stemming from asset revaluations do not generate an explosively growing excess demand for these assets (precisely due to the revaluation of the stock).

Private residents demand three domestic assets: base money (m), interest-bearing public debt (b) and equity (s). Asset stocks m , b and s are expressed in real terms and the corresponding asset demand functions are linear in real domestic wealth (w). The nominal rate of return on bonds (i_b) is fixed but perfect myopic foresight of inflation (π) implies that the ex-ante real return on bonds (r_b) and the real return on base money ($-\pi$) are endogenously determined.

$$(1) \quad r_b = i_b - \pi$$

Given the short term nature of this model we assume that dividends of foreign-held equity, direct foreign investment, foreign transfers and the trade surplus are constant in the period. We assume that all foreign debt is public debt. Note that constant dividends on foreign equity can also be justified because typically there are short term restrictions on profit remittances for DES-financed investments, i.e., profits on new foreign equity cannot be remitted in the short run. This assumption, though, is removed in the long-term model of Section 5. For simplicity of the terms employed, we shall refer to the constant difference between the non-interest current

account (trade surplus plus transfers less dividend remittances) and direct foreign investment as the "trade surplus" t .

The real return on equity (r_s) is equal to the sum of: i) the short-term exogenous physical return on capital (r_k) times the end of period anticipated real price of equity ($q + \delta q^e$); and ii) the expected change in the real price of equity (q^e). Perfect myopic foresight implies that the expected change in the real price of equity equals the actual change in the real price of equity (δq), i.e., q^e is consistent with next period q . Hence, r_s can be written:

$$\begin{aligned} (2) \quad r_s &= r_k * (q + \delta q) / q + \delta q / q \\ &= r_k + \gamma * (1 + r_k) \end{aligned}$$

where: $\gamma = \delta q / q$

δ is the first time derivative of a variable

The foreign sector holds domestic equity (s^f), sovereign debt of the country (f) and other foreign assets (oa). The market price of foreign debt is g . All asset demands are linear in real foreign wealth (w^f). The return on oa (i) is exogenous and the return on equity for foreigners is the same as for residents.

Sovereign debt is a perpetuity with a fixed contractual interest rate (r) which is only partially serviced. Hence, its rate of return (r_f) is the sum of: i) the ratio of the exogenous "trade surplus" or external transfer and the outstanding debt t/f (the actual debt service-debt ratio); ii) the difference between contractual interest and the actual debt service-debt ratio

($r - t/f$, the new liability created by unpaid interest); and iii) the change in price per unit of debt (δg , the capital gain). A similar expression for the rate of return on sovereign debt is employed by Rodriguez (1989) and by Dooley-Symansky (1989).

$$(3) \quad r_f = t/f * g + (r - t/f) * (g + \delta g) / g + \delta g / g$$

Note that since the transfer t goes only to service sovereign debt, debt reduction through DES raises the actual payment t/f as f drops.

Nominal stocks of money and domestic bonds and the real stocks of sovereign debt and equity are fixed, except, of course, for the changes induced by VDR. Given the short term context of our analysis this is not too restrictive. Assuming, for simplicity, a real exchange rate of one and a nominal exchange rate perfectly pegged to domestic prices (and zero foreign inflation) the real stocks of sovereign debt f and other assets oa can be thought of as denominated either in foreign or in real domestic currency.

Due to the end of period formulation of the model all assets/liabilities and wealth are valued at correctly anticipated end of period prices. Assuming initially the price level (p), the real price of equity (q) and of other foreign assets are all equal to one, real domestic wealth (w) and real foreign wealth (w^f) are:

$$(4) \quad w = (M + B) / (1 + \pi) + (s - s^f) * (1 + \gamma)$$

where: M and B are the nominal stocks of money and bonds

π is the rate of inflation

γ is the rate of real equity price increase

$$(5) \quad w^f = s^f * (1 + \gamma) + f * g * (1 + \lambda) + oa$$

where: $\lambda = \delta g / g$

Asset demands depend on domestic rates of return in the case of residents, and on the rates of return on equity, sovereign debt and the (exogenous) rate of return on other foreign assets in the case of foreigners. Since by Walras Law applied to domestic and foreign wealth we can omit the domestic bond and other foreign asset markets the independent market equilibrium conditions are:

$$(6) \quad m = M/(1 + \pi) = m^d(-\pi, r_b, r_s) * w \quad m^d_{\pi} > 0, m^d_b < 0, m^d_s < 0$$

$$(7) \quad s*(1 + q) = s^d(-\pi, r_b, r_s) * w + s^f(r_s, r_f, i) * w^f$$

$$s^d_s > 0, s^d_m < 0, s^d_b < 0, s^f_s > 0, s^f_f < 0, s^f_o < 0$$

$$(8) \quad f*g*(1 + \lambda) = f^f(r_s, r_f, i) * w^f \quad f^f_f > 0, f^f_s < 0, f^f_i < 0$$

where: d superscripts indicate resident's demand functions

f superscripts indicate foreigner's demand functions

subscript letters indicate partial derivatives of asset demand

functions with respect to the corresponding rates of return

After substitution of (4)-(8) in (9)-(11), the system determines π , γ and λ for given values of r_k , i_b , r , i , p , q , g , t , s , s^f , M , B and f .

In order to assess short-term effects of VDR we first sum up the parameter changes (disequilibrium impact) induced by VDR. We focus on DES where the foreign investor swaps foreign public debt for private equity with cash being the intermediary vehicle, and on CDC whereby the new debt is exchanged for the old debt at a discount and both the new and old debt carry

the same interest rate. The discount in the case of CDC stems from free collateral provided by third parties and from seniority attached to the new debt (seniority can be imposed by the providers of free collateral). For simplicity, we assume that the discount of the CDC is equal to the secondary market discount of old debt. In this sense, CDC is equivalent to a direct buyback with borrowed funds.

We assume that both DES and CDC take place at beginning of period prices, i.e., contracts are back-dated. Below we analyze several implications of removing this assumption. In practice, beginning of period prices are a better approximation to the terms of exchange of DES than of CDC because of size. Since CDC are usually larger in size than DES, the deal tends to be implemented at the prices which are expected to prevail at the end of the period.

We assume that initially p and q are equal to one, but by proper choice of the accounting unit this implies no loss of generality. We impose the initial condition that g is smaller than one, i.e., sovereign debt sells at a discount. DES lead to increases in M and s^f and to a reduction in f . To encourage DES the authorities introduce a transitory subsidy ρ equal to the difference between the redemption price of debt at the central bank and the secondary market price. If initially ρ is zero, the change in ρ must suffice to induce foreign investors to absorb the increase in s^f . The parameter changes induced by DES are thus:

$$(9) \quad \delta M = \delta s^f = -g \delta f > 0 \quad (\text{or, } \delta f = -\delta s^f / g)$$

$$\delta \rho = \delta s^f / w^f * s^f_0$$

where: $s^f(.)$ becomes $s^f(r_s, r_f, i; \rho) * w^f$ during the period of the swap

s^f_{ρ} is the partial derivative of $s^f(.)$ with respect to ρ

We assume that the new debt issued for CDC is fully serviced out of the trade surplus t . That is, the new debt carries full seniority, e.g., because it is fully collateralized by third parties with that condition. Thus, we can consider the new debt as part of oa (which yields the rate of return i) and the external transfer t available for servicing old debt becomes $(t - i * \delta oa)$. Since CDC take place at beginning of period prices, the parameter changes induced by CDC are:

$$(10) \quad - \delta f / \delta oa = 1/g > 0$$

$$\delta t = i * g * \delta f < 0$$

If DES take place at end of period prices, then, assuming the government repurchases debt to finance a preset level of equity investment, the changes in the nominal stock of money and in the real stock of foreign debt become endogenous:

$$(11) \quad \delta s^f > 0 \quad (\text{or } \delta s = \delta s^f > 0 \text{ if DES finance new investment projects})$$

The levels of M and f are therefore:

$$(12) \quad \delta M = \delta s^f * (1 + \gamma) * (1 + \pi)$$

$$\delta f = - \delta s^f * (1 + \gamma) / g * (1 + \lambda)$$

And the required subsidy for inducing the swap becomes:

$$(13) \quad \delta\rho = \delta s^f * (1+\gamma) / [(1+\gamma)*(s^f + \delta s^f) + (f + \delta f)*(g + \delta g) + (M + \delta M + B)/(1+\pi)] * s^f_\rho$$

Note that the expression in brackets measures private wealth at end of period prices.

In the case of CDC at end of period terms of exchange, when the government exchanges a given amount of old debt:

$$(14) \quad \delta f < 0$$

The change in the stock of other foreign assets and the external transfer available for servicing old debt are endogenous:

$$(15) \quad \delta a = - \delta f * g * (1 + \lambda)$$

$$\delta t = i * g * (1 + \lambda) * \delta f$$

One crucial limitation of our model is that it ignores the fiscal constraint which best explains the difficulties of many highly indebted countries for servicing foreign public obligations. Fiscal resources not only restrict the level of external transfer which debtors can afford to make but also limit their ability to engage in DES (since DES amount to an anticipated repurchase of foreign public debt). One way to at least partially overcome this limitation is to reinterpret the exogenous trade surplus t as the level of fiscal resources which is available to service public sector foreign obligations. Note that interpreting the trade surplus as the fiscal surplus, (before foreign debt service) implies assuming that private domestic

investment is identical to private domestic savings (From the national accounts basic identity). In this case, though, the exogeneity or constancy of t is even more questionable given the cyclical behavior of fiscal revenues. One way out is, for example, to make t endogenous on the level of output. Output in turn, could depend, via investment, on the price of equity q . If a DES raises the price of equity, thus, fostering investment and output, by alleviating the fiscal constraint (raising t) it would have an additional beneficial effect on the market price of sovereign debt.

Note that if t represents the fiscal transfer, i.e., implicitly assuming that foreign exchange is no longer the binding constraint on debt servicing, it is perfectly justifiable in the case of DES not to subtract profit remittances from t since, clearly, profit remittances are not a government liability. On the other hand, in the case of CDC subtracting the interest on the new debt is legitimate since the new debt also has to be serviced out of domestic fiscal resources.

Having formulated the model we now proceed to examine its comparative static properties.

3. SHORT-TERM IMPACT OF VOLUNTARY DEBT REDUCTION.

We assess the short-term comparative static effects of DES and CDC, implemented at beginning of period prices, on inflation and on equity and sovereign debt prices.

Totally differentiating the system (6)-(8) (after substitution of (1)-(5) and recalling (9)):

$$\begin{aligned}
 & \begin{vmatrix} (m_m^d + m_b^d) * w * (1 + \pi) & m_s^d * w * (1 + \pi) * (1 + r_k) & 0 \\ -m^d(.) * (s - s^f) * (1 + \gamma) & + m^d(.) * (1 + \pi) * (s - s^f) & \\ & & \end{vmatrix} \begin{vmatrix} \delta - \pi \\ \\ \end{vmatrix} \\
 (16) & \begin{vmatrix} (s_m^d + s_b^d) * w * (1 + \pi) & (s_s^d * w + s_s^f * w^f) * (1 + r_k) & f * g * s^f(.) + \\ + s^d(.) * (M+B)/(1+\pi)^2 & + (s - s^f) * s^d(.) - s + s^f * s^f(.) & s_f^f * w^f * (1 + r - t/f) \\ & & \end{vmatrix} \begin{vmatrix} \delta \gamma \\ \\ \end{vmatrix} \\
 & \begin{vmatrix} 0 & f_s^f * w^f * (1 + r_k) & w^f * f_f^f * (1 + r - t/f) \\ & + s^f * f^d(.) & - f * g + f^f(.) * f * g \end{vmatrix} \begin{vmatrix} \delta \lambda \\ \\ \end{vmatrix} \\
 & \begin{vmatrix} 1 - m^d(.) & m^d(.) * (1 + \pi) * (1 + \gamma) & 0 \\ & & \\ -s^d(.) / (1 + \pi) & - (1 + \gamma) * s^f(.) & -g * (1 + \lambda) * s^f(.) \\ & + (1 + \gamma) * s^d(.) & -s_f^f * w^f * (t/f^2) * \\ = & \delta M + & \delta s^f + * (1 + \lambda - 1/g) \delta f \\ & & \\ 0 & - f^f(.) * (1 + \gamma) & g * (1 + \lambda) * (1 - f^f(.)) \\ & & - f_f^f * w^f * (t/f^2) * \\ & & * (1 + \lambda - 1/g) \\ \\ 0 & & 0 & 0 \\ & & & \\ + & -s^f(.) / (1 + \pi) \delta \alpha + & -s_f^f * w^f * [(1/f * g) - (1/f) * (1 + \lambda)] \delta t + & -s_\rho^f * w^f \delta \rho \\ & & & \\ & -f^f(.) & -f_f^f * w^f * [(1/f * g) - (1/f) * (1 + \lambda)] & 0 \end{vmatrix}
 \end{aligned}$$

The sign of the determinant of (16) is ambiguous. However, if the dynamic counterpart of the system (6)-(8) (e.g., dynamic equations that make $-\pi$, γ and λ a function of excess demand in the money, equity and debt markets) is locally stable the correspondence principle implies that the sign of the determinant is negative.

Alternatively, the following partial equilibrium conditions imply that the matrix of (16) is a diagonal matrix with all elements of the diagonal negative and, hence, are sufficient for ensuring a negative determinant and local stability (a_{ij} refers to the element of the i th row and j th column of the matrix of (16):

- i) An increase in anticipated inflation (π) leads to a partial equilibrium excess demand for money, since the stock of money valued at anticipated end of period prices drops faster than demand, i.e., $a_{11} < 0$.
- ii) An increase in the anticipated rate of increase of the price of equity γ (debt λ) creates a partial equilibrium excess supply of equity (debt), since the expected valuation of the equity (debt) stock exceeds the increase in demand for the stock, i.e., $a_{22} < 0$ ($a_{33} < 0$).
- iii) The drop in demand for an asset due to an increase in the expected appreciation of a substitutable asset is offset, at a partial equilibrium level, by the positive wealth effect stemming from the asset appreciation, i.e., a_{12} , a_{21} , a_{23} and a_{32} all equal zero.

The short-term comparative static multipliers of DES and CDC under conditions i) to iii) are reported in Table 1:

Table 1: Short-Term Impact Effects of DES and CDC ^{1/}

	<u>Changes in Endogenous Variables</u>		
	<u>π</u>	<u>γ</u>	<u>λ</u>
DES	+	+ 2/	+
CDC	0	+ 3/	+ 3/

Notes: 1/ Assuming that initially the system is in a steady state where π , γ , and λ are zero (note that λ equal zero is consistent with $g < 1$). The comparative static results are based on equations (12)-(13), that is, VDR implemented at beginning of period prices.

2/ A sufficient condition for this is that i be larger or equal than r or alternatively that s^f is initially small. To obtain this comparative static result note that condition iii) implies that:

$-s_f^f * w^f / s^f(.) = f * g / (1 + r - t/f)$, and that the steady state price of debt is $g^{ss} = (t/f) / (i - r + t/f)$.

3/ Recalling that $g^{ss} = (t/f) / (i - r + t/f)$ and condition ii). Note from (13) and g^{ss} that t/f falls with CDC since

$$[t - i * g^{ss} * \delta f] / [f - \delta f] < t/f.$$

The initial excess supply of money brought about by DES leads to higher inflation. Although inflation is fully anticipated and hence demand for money drops, the contraction in real money balances is larger (condition i)) and, hence, as inflation increases the excess supply of money is eliminated. The anticipated increase in the price of equity has no net impact on the money market: the higher opportunity cost of holding money, due to expected equity appreciation, is compensated by the increase in wealth induced by equity appreciation (condition iii)).

DES induce a transitory excess demand for equity and, hence, higher equity prices. Demand for equity increases due to the subsidy ρ which outweighs the negative impact on demand of a higher actual debt service-debt ratio (t/f). Note that if profit remittances from DES-financed investments were allowed, the exogenous component of the return on debt (t/f) could drop, thus, reinforcing the excess demand for equity. The increase in equity demand due to its correctly anticipated appreciation falls short of the increase in value of the equity stock (condition ii)). Thus, when equity prices increase the excess demand for equity is eliminated. As before, the negative impact of the anticipated appreciation of sovereign debt on equity demand is offset by higher foreign wealth due to debt revaluation (condition iii)).

DES also create a transitory excess demand for sovereign debt which pushes upward its price. The initial excess demand for debt is both due to reduction in the debt stock and to the increase in demand induced by a higher actual debt service-debt ratio (t/f). Note, though, that in the absence of restrictions on profit remittances t/f could drop and, hence, push debt prices down.

With higher real equity and debt prices foreign wealth increases. Domestic private wealth may either increase or decrease. The outcome depends on whether the inflation erosion of money and domestic debt is smaller or larger than real equity appreciation (since we employ a Keynesian-type wealth formulation sovereign debt appreciation does not lead to reductions in domestic wealth). The higher the elasticity of money demand with respect to anticipated inflation and the lower the elasticity of demand of equity with respect to its own rate of return the more likely that domestic wealth will drop.

In the case of CDC, domestic and foreign wealth are initially unchanged since the voluntary nature of the exchange implies that exchanged old debt matches in value the increase in new debt. The price of sovereign debt rises because old debt reduction is larger than the drop in demand for debt induced by a lower actual debt service-debt ratio. The latter ratio falls since small CDC lower the external transfer allocated to old debt servicing proportionately more than it reduces old debt (see footnote 3 in Table 1).

Demand for equity and equity prices increase due to the drop in the actual debt service-debt ratio. The negative impact on equity demand of debt appreciation is offset by the positive impact on demand of higher foreign wealth (condition ii)).

In short, CDC raises the real prices of sovereign debt and equity. The domestic price level doesn't change because the increase in private wealth (and hence money demand) due to the higher real price of equity is offset by the drop in money demand induced by the anticipated rise in the price of equity (condition iii)). Since the domestic price level is unchanged, both

domestic and foreign wealth increase due to higher equity and debt prices.

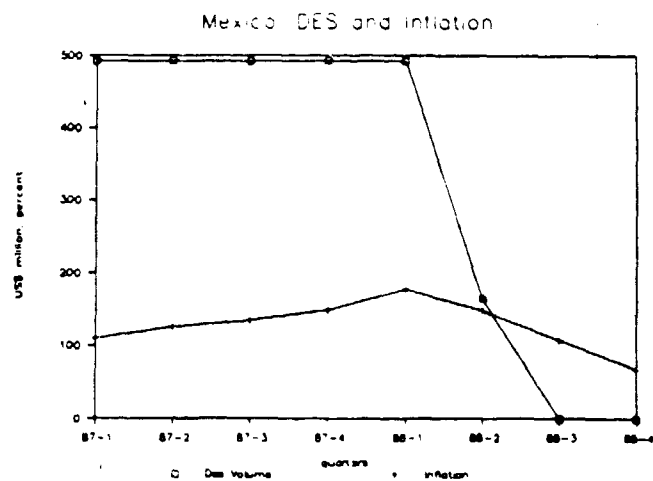
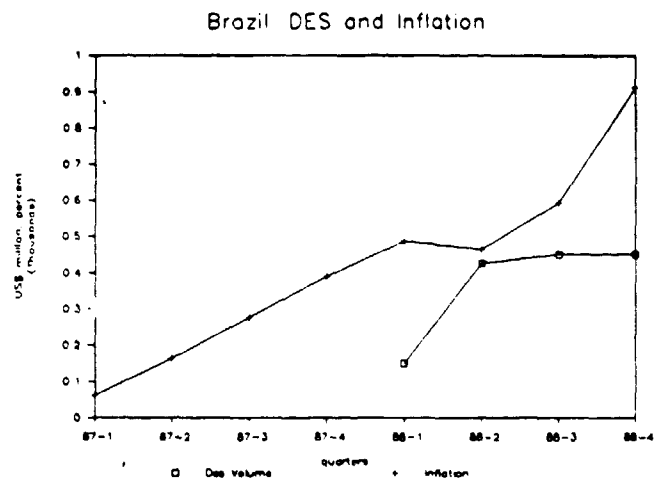
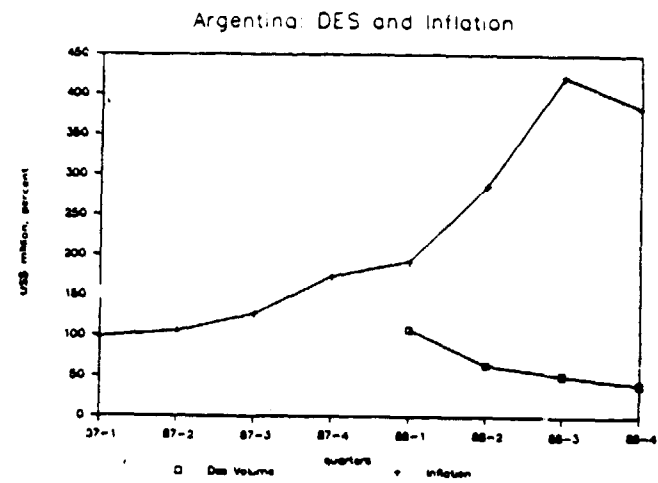
Note that the secondary market price of debt rises more under DES than under CDC. This is a consequence of the assumption that profits on DES-financed foreign equity are not remitted abroad, whereas new debt created through CDC is fully serviced. This assumption implies that the exogenous component of the rate of return on debt (t/f) drops in the case of CDC while it rises in the case of DES, hence, leading to a higher excess demand for debt in the case of DES.

4. Recent Experience in Latin America.

Argentina, Brazil, Chile and Mexico were the four Latin American countries with more sizable VDR programs. To assess the consistency of the model predictions with empirical evidence from these countries we inspect a series of inflation, secondary market prices and stock market price indices (the proxy for equity prices).

Figure 1 charts the evolution of the rate of inflation and of the volume of DES in Argentina, Brazil and Mexico (Chile is excluded because DES were bond-financed). We exclude informal DES partly because data is less reliable and often unavailable, and partly because informal schemes consist of swaps of private (or public) firm's equity for private (public) firm's debt, i.e., they are not the type of DES we considered in the model. The volume of DES corresponds to the month of the auction and, when the month of the auction is unknown, the annual level of DES was prorated on a monthly basis.

Figure 1. Debt-Equity Swaps and Inflation in Latin America.



Note that during periods in which DES were implemented inflation was, on average, growing. In Argentina and Brazil inflation rose in three out of the four quarters during which DES were implemented (until 1988). The positive correlation between inflation and the DES volume is even more obvious in the case of Mexico. It is clear, though, from the sheer size of DES vis-a-vis other factors of the money supply, e.g. fiscal deficits, that DES alone cannot account for inflation. Yet, its impact on the margin could have been sizeable, and what is more important, easily managed by putting restrictions on DES programs, e.g., reportedly in Mexico. In some countries, such as Chile and Brazil, restrictions on debt-debt VDR were more directly targeted at colling off pressures in foreign exchange black markets. since foreign exchange is demanded by firms to repurchase their debt at a discount.

Table 2 reports secondary market prices, deflated stock market price indices and actual volumes of official debt reduction (DES, CDC and debt buybacks) in Chile and Mexico. These are the two Latin American countries with longer official programs of VDR.

Over the same period in which the Chilean DES program was in force the Chilean stock market price index exhibited an upward trend. This is precisely what the short-term model predicted. However, other factors such as steady growth, structural reforms and economic and political stability have probably been more important determinants of the stock market trend. Although the linkage between the DES program and the stock market trend is consistent with the evidence, the significance, and even the direction, of causality are far from warranted.

Table 2: Voluntary Debt Reduction, Secondary Market Prices and Stock Markets in Chile and Mexico
(million US\$)

	1985			1986			1987			1988		
	<u>DES</u>	<u>CDC</u>	<u>BB</u>	<u>DES</u>	<u>CDC</u>	<u>BB</u>	<u>DES</u>	<u>CDC</u>	<u>BB</u>	<u>DES</u>	<u>CDC</u>	<u>BB</u>
Chile ^{1/}	126		115	297		411	832		696	993		1208
Mexico ^{2/}				983			1966			655	3665	

	1985		1986		1987		1988	
	<u>SMP</u>	<u>SMI</u>	<u>SMP</u>	<u>SMI</u>	<u>SMP</u>	<u>SMI</u>	<u>SMP</u>	<u>SMI</u>
Chile		39.2	66.5	62.9	64.1	95.5	58.1	102.5
Mexico			58.0	100.0	53.7	155.0	47.4	75.0

Notation: BB debt buybacks
 SMP average secondary market prices of sovereign debt
 SMI average deflated level of stock market price index

Notes: 1/ BB in the case of Chile refers to Chapter 18 operations whereby the private sector officially repurchased its foreign debt. Only US\$ 298 million correspond to Central Bank BB.
 2/ Total DES under the program suspended in April 1988 was US\$ 3.6 billion. Lack of data regarding the DES timing led us to prorate between June 1986 and April 1988 the actual volume.

In the case of Mexico there is also a positive correlation between the volume of DES and the stock market price index. Both grew during 1987 and dropped during 1988. The Mexican DES program was interrupted in April 1988, reportedly due to its inflationary consequences. However, other factors than the ones illustrated by the model have probably been at least as important. For example, in 1987 structural reforms are likely to have pushed the stock market index upwards. And high domestic real interest rates, partly a consequence of a price stabilization program, have most likely exerted downward pressure on the stock market during 1988.

On the other hand, against model predictions, secondary debt prices declined. Lower debt prices were, among other reasons, a consequence of higher loan-loss provisions and loan charge-offs by commercial banks with heavy exposure in highly indebted countries in mid-1987, higher foreign interest rates, and relatively poor economic growth. In the case of Chile by late 1987 debt prices started recovering and resumed an upward trend continued through 1989. In the case of Mexico, the March/April 1988 \$ 3.6 billion CDC exerted a visible favorable impact on debt prices, but this was not enough to revert the downward price trend. The distinct behavior of debt prices of Mexico and Chile in the long run, though, is accounted for by the model introduced below.

5. A DYNAMIC MODEL FOR ASSESSING DEBT-EQUITY SWAP PROGRAMS.

In the model of the previous sections asset stocks were fixed and profit remittances were determined exogenously (i.e., not affected by DES).

We now introduce a financial model that incorporates dynamic equations describing the accumulation of sovereign debt and equity, and where foreigners holding domestic equity are allowed to remit profits abroad. In Subsection 5.1 we describe the model and in Subsection 5.2 we derive conditions under which DES have a positive impact on the steady state prices of sovereign debt and equity. In Section 6 we parametrize some of those conditions for Argentina, Brazil, Chile and Mexico. There we conclude that DES are likely to exert a positive impact on debt prices in the cases of Brazil and Chile, and a negative impact in the cases of Argentina and Mexico.

5.1 The Model.

We suppose that there is perfect arbitrage between a riskless foreign asset, sovereign debt and equity of the debtor country. We assume perfect myopic foresight of all prices and rates of return. Arbitrage by the foreign sector ensures that the return on sovereign debt, the sum of paid interest, capitalized unpaid interest and the correctly anticipated change in debt price, matches the foreign rate of interest \underline{r} plus a risk premium factor \underline{a} .

Unlike in the short-term model, profits from foreign equity acquired through current DES can be remitted abroad. However, the government imposes the restriction that only a proportion α of profits (excluding capital gains) can be remitted. Otherwise, profit remittances carry seniority over foreign debt. Thus, the trade surplus available to service sovereign debt t is the difference between the exogenous "trade surplus" t^* and profit remittances, i.e., $t = t^* - \alpha r_k^* s$. In the long run t^* ought to be made endogenous on the level of output or investment, particularly when there are increasing returns to scale. We discuss this issue in Subsection 5.2.

The arbitrage condition between the riskless foreign asset and debt is, hence:

$$(17) \quad r + a = (t^* - \alpha r_k^* s)/f \cdot g + [r - (t^* - \alpha r_k^* s)/f] + \delta g/g$$

The second term on the right hand side measures the increase in the sovereign debt stock through interest capitalization:

$$(18) \quad \delta f = [r - (t^* - \alpha r_k(s) \cdot s)/f] \cdot f$$

We assume that the physical return on capital r_k is a function of the level of equity:

$$(19) \quad r_k = r_k(s)$$

Arbitrage ensures that the risk-adjusted return on equity matches the return on the riskless foreign asset. The return on equity has three components: actual profit remittances ($r_k \cdot \alpha$); the new asset created by profits which could not be remitted abroad ($r_k \cdot (1 - \alpha)$); and capital gains (δq). If c represents the risk of holding equity vis a vis the riskless foreign asset, the other arbitrage condition is:

$$(20) \quad r + c = \alpha r_k(s)/q + (1 - \alpha) r_k(s) + \delta q/q$$

As before, the second term on the right hand side measures the increase in the stock of foreign held equity derived from restrictions on profit remittances (α). For simplicity, we assume that α sets a binding constraint on profit reinvestment, i.e., reinvestment does not take place voluntarily.

$$(21) \quad \delta s^f = (1 - \alpha) r_k(s) \cdot s^f$$

5.2. Steady State Effects

Steady state debt and equity prices, obtained equating to zero the rates of change of g and q in (17) and (20), are:

$$(22) \quad g^{ss} = [(t^* - \alpha r_k(s^*)s^{f*})/f] / [a + (t^* - \alpha r_k(s^*)s^{f*})/f] < 1 \quad \text{since } a > 0$$

$$(23) \quad q^{ss} = \alpha r_k(s^*) / [r + c - (1 - \alpha)r_k(s)]$$

where: s^* is the steady state level of the equity stock

s^{f*} is the steady state level of the equity stock held by
foreigners

Or, in the particular case in which α equals 1:

$$(24) \quad q^{ss} = r_k(s^*) / (r + c)$$

If, for illustrative purposes, we assume that α equals one, equity carries full seniority vis a vis sovereign debt or, in other words, remittances crowd out debt service.³ This ensures that there is no forced foreign equity accumulation through reinvestment of profits. The absence of restrictions on profit remittances is consistent with the view that the main constraint on foreign debt servicing is a fiscal constraint, rather than a

3. Actually this is not true, particularly in the case of profit remittances of equity acquired through DES, e.g., in Mexico. In the case of Chile, some foreign investors prefer to avoid the DES channel precisely for fear that discretionary restrictions on profit remittances could be enforced. These restrictions are less likely to be enforced on conventionally financed foreign investment.

foreign exchange constraint. Since profits on foreign held equity are not a drain on fiscal resources, if foreign exchange is not a binding constraint, there is no reason to expect restrictions on profit remittances, at least as long as these do not become relatively sizeable.

A steady state requires that r equals $(t^* - \alpha r_k(s) * s) / f$. Thus, the steady state level of debt, f^* , is:

$$(25) \quad f^* = r / (t^* - \alpha r_k(s^*) * s^{f^*})$$

If r exceeds the $(t^* - \alpha r_k(s) * s^{f^*}) / f$ ratio, sovereign debt accumulates explosively. A steady state can be attained by raising the trade surplus t^* , or by reducing r , f or $\alpha r_k(s) * s^{f^*}$. Since the trade surplus t^* is the less exogenous of those factors, it is conventionally the one that adjusts to warrant the steady state. However, with high debt and interest rates, and low levels of domestic absorption debtor countries are facing severe difficulties in further widening their trade surpluses. Schemes of debt or interest rate reduction, or restrictions on profit remittances (a lower parameter α), thus, become alternatives for preventing debt growth through capitalization of unpaid interest.

What is the impact of DES on the steady state price of debt (g^{ss}) and equity (q^{ss}) ?

A DES implemented at beginning of period prices is characterized by:

$$(26) \quad \delta s = -\delta f * g^r > 0$$

where: g^r is the redemption price of foreign debt

By differentiating g^{ss} (see (22)) with respect to s subject to (26), we find that g^{ss} increases (drops) if the inequality (27) is positive (negative):

$$(27) \quad \delta g^{ss} / \delta s|_{DES} > (<) 0 \text{ iff:}$$

$$\begin{aligned} & (t^* - \alpha r_k(s) s^f) / f g^r - \alpha (r_k + r_k' s^f) = \\ & = t^* / f g^r - \alpha r_k (s^f / f g^r + 1) - \alpha r_k' s^f > (<) 0 \end{aligned}$$

$$\text{where: } (t^* - \alpha r_k(s) s^f) > 0$$

That is, the price of debt will increase (drop) if f , g^r , α , r_k , or s^f (assuming $r_k/f > -r_k'$) are relatively small (large) or if t^* is relatively large (small). It is straightforward that a lower stock of debt will be associated with higher debt prices in the steady state (for given levels of all other factors). On the other hand, a large t , by increasing the capacity to service debt, also raises the price of debt. A low g^r favors steady state debt prices because (after the DES) it increases the proportion of debt which can be serviced. The favorable terms of exchange (low g^r) implies that little equity is given in exchange for debt, and implies that the level of foreign transfer available for debt service (i.e., after servicing equity) falls relatively less than debt drops.

A similar intuition applies in the case of a low r_k or a low α . In both cases, DES have a beneficial impact on debt prices because the level of foreign transfer available to service foreign debt drops relatively less than foreign debt (since profits or remittances are small relative to equity).

Note that r_k' can be negative, zero or positive according to whether there are decreasing, constant or increasing returns to scale. With decreasing (increasing) returns to scale DES lower (raise) the average physical return on capital, hence, reducing (raising) the rate of profit remittances and raising (reducing) the price of debt accordingly. The story could be made more realistic if we endogenize t^* on investment, e.g., t^* is bound to increase with increasing returns to scale. In this case it is conceivable that DES may also raise debt prices since, although profit remittances increase, the foreign transfer could increase proportionately more, thus, increasing the proportion of debt which can be serviced.

The technology reflected in $r_k(s)$ is even more crucial for assessing the impact of DES on the steady state equity price (q^{ss}). Differentiating q^{ss} (see (24)) with respect to s subject to the (26) constraint, we find that the DES impact on q^{ss} is negative, neutral or positive depending on whether there are decreasing, constant or increasing returns to scale.

$$(28') \quad \delta q^{ss} / \delta s|_{DES} = r_k' / (r + c) < (= \text{ or } >) 0 \quad \text{iff } r_k' < (= \text{ or } >) 0$$

Note, however, that we have not introduced an equation describing total equity accumulation and, hence, s^* is so far determined exogenously.

Alternatively, we can describe equity accumulation by a Tobin Q-ratio type of investment function. In this case, investment takes place whenever the Q-ratio, the ratio between the market price of capital and its replacement cost, is larger than one. If we reinterpret q as the Tobin-Q ratio and assume that only "foreigners" invest in equity,⁴ equity investment is:

4. It is clear that even if only subsidized investment takes place, foreigners are not the only ones that will invest in equity (through DES).

$$(29) \quad \delta s = \delta s^f = I[q - 1]$$

where: $I(.)$ is the equity investment function

$$I(-) < 0, \quad I(0) = 0, \quad I(+) > 0, \quad I'(q - 1) > 0$$

The case in which only foreigners invest in equity can be justified because DES-financed foreign investment is subsidized). In some cases where residents also participate in DES, there is a deliberate differential (lower) subsidy to residents, e.g., Chapter 18 operations in Chile, and the subsidy is usually close to the premium of the parallel exchange rate over the official one.

In the steady state, when δs equals 0, q must be one. Hence, r_k should equal $(r + c)$ (see equation (23)).

In this case, unless we assume constant returns to scale, r_k constant, there is only one possible steady state level for the equity stock, i.e., that level of s consistent with q equal to one. Thus, with increasing or decreasing returns DES may only induce transitory changes in the real stock of equity.

To encourage the foreign sector to participate in a DES governments typically offer a subsidy ρ :

$$(30) \quad \rho = (g^r - g)/g$$

where: g^r is the redemption price of debt at the Central Bank

But "foreigners" here may be understood as foreigners and residents holding sovereign assets and acting otherwise as foreigners (from an economic point of view).

With perfect foresight the DES subsidy immediately translates into a higher price of equity q . The higher equity price, in turn, fosters equity investment. The government fixes the subsidy so as to encourage enough equity investment to repurchase the desired amount of debt. With constant returns to scale, once the subsidy is cut q drops back to one and the economy reaches a new steady state with a higher level of equity.

With decreasing returns to scale, as equity grows (following the subsidy announcement) the physical return on capital drops and, thus, drives down the price of equity. Once q falls below one it induces equity disinvestment, e.g., via depreciation, up to the point where the equity stock returns to its initial level and the price of equity becomes one again. At the new equilibrium the share of foreigners in domestic equity is likely to increase.

6. Some Applications to Latin America.

To illustrate the model result about the DES impact on the steady state price of debt we parametrize inequality (27) employing data from Argentina, Brazil, Chile and Mexico. According to the model, a positive (negative) sign of the inequality implies that DES raise (lower) the steady state price of sovereign debt. Table 3 provides the parameter values and the estimated value of inequality (27) for each country.

To approximate the parameter t^*/f we employ the average trade surplus-debt ratio of 1986-87. The parameter s^f/f is measured by the ratio of the stock of foreign investment to total foreign debt for the last year for which foreign investment stock figures were available. The parameter g^r is

approximated by the average redemption price less central bank fees; it corresponds to the 1988 average price of DES for each country. The parameter α is approximated by the difference between one and the percentage of years over which profit remittances were prohibited (under the last or current DES program) in the last ten years. For all countries we assume constant returns to scale, i.e., r_k equal to zero, and a real rate of return on capital of 6.8 percent. The 6.8 percent rate was obtained subtracting the US rate of inflation from the nominal average rate of return of US foreign direct investments for all Latin America in the year 1985 (see footnote 4 of Table 3). The evidence reported in Table 3 indicates that DES will raise secondary market prices in the cases of Brazil and Chile, and reduce them in the cases of Mexico and Argentina. Note, however, that the price impacts are very small and are sensitive to the assumptions made.

Table 3. Steady State Impact of DES on Sovereign Debt Prices ^{1/}.

	<u>Estimated Parameter Values (%)</u>					<u>Price Impact</u>
	<u>t[*]/f</u>	<u>g^r</u> ^{2/}	<u>α</u>	<u>s/f</u> ^{3/}	<u>r_k</u> ^{4/}	<u>δg</u>
Argentina	3.2	57	75	20	6.8	- 0.015
Brazil	8.2	68	100	24	6.8	0.025
Chile	5.6	86	75	11	6.8	0.006
Mexico	6.2	87	.00	16	6.8	- 0.012

Note: 1/ Based on inequality (27)

2/ Estimates were obtained from Larrain (1989), Sanguines (1989), and Rodriguez (1989).

3/ The sources for the stock of foreign direct investment are "IRM Directory of Statistics of International Investment and Production", Macmillan 1987; and 'Foreign Direct Investment in Selected Developing Countries in the Last Two Decades', Gyorgy Becsky, World Bank, draft

It corresponds to the year 1984 for Chile and Mexico, 1983 for Argentina and 1985 for Brazil.

- 4/ Is based on the 1985 average rate of return on all US foreign investment in Latin America, which was 10 percent, after subtracting the US inflation rate . The source is: "Transational Corporations in World Development", New York, 1988, United Nations Centre on Transational Corporations.

Large trade surpluses (as a proportion of debt) in Brazil and low trade surpluses in Argentina are crucial for explaining the differential effect of DES on debt prices in the case of these countries (Table 3). The larger the trade surplus-debt ratio the more debt reduction raises the actual debt service-debt ratio and, therefore, the more debt prices rise. On the other hand, restrictions on profit remittances under the DES regime, and lower levels of foreign held equity in Chile, compared with Mexico, may explain the favorable effect of DES on debt prices in the former country and the negative effect in the latter.

7. CONCLUSIONS

The main findings of this paper can be summarized as follows:

- i) The widespread view that money-financed DES feed inflation was modelled in a short-term portfolio balance framework. Casual inspection of DES and inflation data of Argentina, Brazil and Mexico support this view.
- ii) The short term end of period portfolio model also predicts that debt-equity swaps and debt conversions raise sovereign debt prices. This is due to old debt reduction and, in the case of debt-equity swaps, to short term restrictions on profit remittances (short-term restrictions on profit

remittances imply that the proportion of old debt actually serviced increases after the swap). Casual inspection of the evidence suggests that in the cases of Mexico and Chile voluntary debt reduction schemes have exerted a favorable impact on debt prices. However, the impact of other factors such as bank provisions against loan losses and chargeoffs, has probably been at least as important.

- iii) In the short term portfolio balance framework, we also show that debt reduction schemes push equity prices upwards. In the case of debt-equity swaps, this is due to the subsidy, given by the difference between redemption prices and secondary market prices, to foreign investors which creates an excess demand for equity. In the case of debt conversions, the excess demand for equity stems from portfolio substitution induced by the drop in the actual debt service-old debt ratio of old debt. Both in Mexico and Chile the proxy for equity prices, a stock market price index, exhibits a positive correlation with the volume of debt-equity swaps. However, factors such as structural reforms in Chile and Mexico, and the 1988 stabilization plan in Mexico, have probably been at least as important determinants of stock market prices.
- iv) Finally, we formulate a long-term dynamic model, where profit remittances on foreign held equity acquired through DES are endogenous. We show that debt-equity swaps are more likely to raise (lower) the steady state price of debt the larger (smaller) the levels: of the exogenous trade surplus, of

restrictions on profit remittances, and of the redemption price of debt, and the smaller (larger) the levels of debt and of the physical return on capital.

- v) A parametrization of the conditions under which debt-equity swaps raise secondary market prices, indicates that debt-equity swaps are more likely to improve steady state debt prices in the cases of Brazil and Chile, than in the cases of Argentina and Mexico. .
- vi) In the long term model technology also matters: we show that the positive impact of debt-equity swaps on debt prices may be reduced when there are increasing returns to scale, since higher profits and profit remittances lower the part of the trade surplus available to service debt (hence reducing its steady state price). On the other hand, increasing returns could also raise the trade surplus (here treated as exogenous), thus, neutralizing that effect.
- vii) An important feature of the model is that without constant returns to scale debt-equity swaps can only induce transitory increases in the steady state stock of equity. The type of technology is also important for assessing the steady state impact of debt-equity swaps on equity prices.
- viii) One crucial limitation of our long term analysis is the exogeneity of the trade surplus, particularly when there are increasing returns to scale. Some of the long term comparative static multipliers could be reversed in sign (see vi).

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